

SCIENCE

FRIDAY, SEPTEMBER 7, 1888.

ONE OF THE IMPORTANT functions of a State geological survey is to furnish accurate and impartial information on the general character of so-called 'mining districts.' Nearly all of our State geologists have had experience in such matters, from the early days when the 'black shale' was exploited for coal, to the later times, when certain iron-fields in Wisconsin needed discouragement. The most recent example comes from Arkansas, where much excitement has arisen in a mining district from which rich discoveries of valuable metals were reported. Professor Branner, recently appointed State geologist, was called upon to examine the region and its ores, and as he failed to find evidence of value in them, and clearly stated his unflattering results in a brief report, he is now made the object of violent abuse from the parties whose hopes are dashed by his work. The better people of the State, however, are with him, and, with their support in his honest course, we shall hope to see his survey continue and thrive. He was elected secretary of the geological section of the American Association at the Cleveland meeting, his nomination being in part due to a desire on the part of his colleagues to express their appreciation of his integrity and their approval of the course he has taken.

THE IMPORTANCE OF PRESERVING the forests becomes evident in South Africa. J. G. Gamble, in the Proceedings of the Institute of Civil Engineers, points out that the soil of Africa becomes dryer every year. Although the amount of precipitation is not decreasing, the springs become less strong, and rivers that used to flow permanently are dry during summer. Gamble considers the devastation of forests, and the grass and bush fires, the principal reasons for this state of affairs. Besides this, the trails made by animals are transformed into cañons of considerable depth by sudden rain-falls. In these cañons, which are in some cases more than thirty feet deep, the surface water runs off before it has time to percolate the soil. Tripp has made observations on the amount of evaporation, and found that on the highlands fully one-half of the falling rain runs off without penetrating into the soil. This experience emphasizes the fact that the ultimate aim of rational forest-culture, so far as its influence upon agriculture is concerned, is the increase of the power of the ground to hold moisture, and thus to prevent the rapid flowing-off of the precipitated rain.

THE PILOT CHART for September, under the title 'Transatlantic Routes,' refers to the collision between the two Danish steamships 'Geiser' and 'Thingvalla,' Aug. 14, about thirty miles south from Sable Island, the sinking of the former in a few minutes, and the drowning of 117 persons, and adds, "The Pilot Chart for December, 1887, discussed this subject of transatlantic navigation at some length, and a supplement was published calling attention to the importance of some general understanding as to the routes to be followed by eastward and westward bound vessels. The plan thus inaugurated has been adhered to each month since that time, one track being plotted as the southern limit for westward-bound vessels, and another as the northern limit for eastward-bound vessels." This discussion, in which it was stated to be "the object of this chart to recommend only what masters of vessels may reasonably be expected to follow, having due regard to the mutual benefits to be derived from such an agreement, as well as the mutual concessions to be made in order to make it effective,"

was reviewed editorially at some length in No. 256 of *Science*, so that it is unnecessary to repeat it here; but it is pertinent to remark, that on the Pilot Chart for each of the last ten months the transatlantic routes recommended for eastward and westward bound steamships for the succeeding month have been carefully plotted; and this fact adds startling emphasis to the closing sentence of the note on the September chart, which is as follows: "This recent disaster would not have occurred had the 'Geiser' been farther to the southward, as recommended for eastward-bound vessels; and the collision thus emphasizes the importance of this matter, not only to owners, agents, masters, and marine underwriters, but to the public generally." This fixes the responsibility for the loss of the 'Geiser,' and the appalling sacrifice of life and property that resulted, beyond the possibility of question; for, as every reader of *Science* knows, the Pilot Chart is published on the first day of each month, and enough copies are furnished at each Atlantic port of the United States to furnish a copy, free of cost, to every vessel that departs during the month. The captain who does not pay heed to its recommendations assumes a fearful personal responsibility, which should not be overlooked in fixing the severity of the punishment he is to receive if disaster results from this neglect. The work of the United States Hydrographic Office is universally recognized as the best of its kind done in the world, and mariners cannot afford to disregard its recommendations.

MR. EVERETT HAYDEN, who is in charge of the meteorological division of the Hydrographic Office, and who has recently distinguished himself by his exhaustive study of the great storm of last March, the results of which are about to be published at length, illustrated by a series of six superb charts, as well as by his contributions to the monthly Pilot Chart, which, under his direction, has become a most wonderful compendium of information that is of vital interest to mariners, has been authorized by Commodore Harmon, acting secretary of the navy, to go to Havana, Cuba, for the purpose of studying the laws of hurricanes. Mr. Hayden will visit the observatory of the Real Collegio de Belen, in Havana, the director of which has carried the study of hurricanes further than any other student of the subject in the world; and he will carry from Washington a great mass of material which he has already collected, and which he hopes to work up in the light of additional information which he expects to obtain in Havana, and from the actual observation of hurricanes during the remainder of the hurricane season. Mr. Hayden expects to be absent about six weeks. Very soon after his return he will make a special report. He also hopes to be able to qualify himself, as no one in the United States is now qualified, to discuss hurricanes in such a manner as to be able to give to the navy and commercial marine of this country, and of all other countries whose ships navigate the North Atlantic Ocean, much most valuable, practical information, and to contribute important data to the science of meteorology.

PHOSPHORUS PENTOXIDE AS A DISINFECTANT.

SINCE the publication in *Science* of the report of a series of experiments conducted by the Marine Hospital Service at the quarantine station below New Orleans to determine the efficacy of the different disinfectants used, and especially since that article has been copied in so many of the medical journals of the country, great interest has been manifested among quarantine officers, city health-officers, sanitarians, and chemists, in the discovery of some additional disinfectant. Phosphorus pentoxide was suggested, and

its use widely advocated, on account of its supposed deadly effect upon disease-germs and the convenience of its use. The amount of phosphorus required to produce a given volume of fumes is so much smaller than that of sulphur, and it can be so much more easily placed in the most favorable positions for its fumes to reach the article to be disinfected, that there was a general inclination to substitute it for sulphur.

In order to ascertain definitely what the value of phosphoric acid is, as a disinfectant, Surgeon-General Hamilton, about three weeks ago, as was noticed in *Science* at the time, instructed Dr. Kinyoun, surgeon in charge at New York, to make a series of experiments with phosphorus pentoxide for the purpose of determining its utility and applicability for general disinfection. Dr. Kinyoun has made his report, and it will be printed in Dr. Hamilton's abstract tomorrow. He has courteously consented that it shall be published in the present number of *Science*. It is as follows:—

"I have the honor to state that I have, in accordance with your instructions as per letter of Aug. 15, made a series of experiments with the fumes of phosphorus pentoxide, in view of determining its utility and applicability for general disinfection. As a fact well known in chemistry, when phosphorus is ignited in a full supply of air, phosphorus pentoxide is formed, being a white amorphous powder, volatilized by heat, and absorbing moisture with the utmost avidity. It unites with water, forming hydrogen phosphate or phosphoric acid.

"When phosphorus is ignited in a closed vessel, the amorphous powder of phosphorus pentoxide is precipitated on the bottom and sides. It is never in suspension longer than forty minutes after the combustion has been completed.

"For the purpose of experimenting, a cask holding five hundred litres was made use of for testing the germicidal powers of the oxide. At first the phosphorus was placed in the bottom of the cask; but it was found necessary to place it near the top, and protect the cask by asbestos, on account of the great heat involved. This procedure gave as a maximum heat at the bottom, where the cultivations were placed, 32° C.

"The first observation was made to determine the penetrating-power of phosphorus pentoxide, which was done in the following manner: Fifteen test-tubes (1" x 5") were used, in which were placed several pieces of litmus that had been rendered alkaline by a solution of carbonate of soda. All the strips of paper were saturated before being placed in the tubes. Several of the tubes were left open, and were put in several positions,—some vertically, mouths upward; some horizontally, and then suspended mouths downward. Another series was covered with one, two, three, and four layers of dry filter-paper. Another series was covered with muslin, one, two, three, and four layers. A fourth was covered with flannel, one, two, three, and four layers. A fifth was covered with cotton, one, two, three, and four layers.

"All the above were placed in various positions in the vessel, and twenty grams of phosphorus ignited, and the cask sealed. It was opened twenty-four hours thereafter. There was no change observable in the color of the litmus-paper in those tubes that had been closed with the substances as noted above. In the tubes that were open, all had been acted upon by the acid, most in those which had been placed mouths upward, and least in those suspended mouths downward.

"The test-tubes that were covered with paper, etc., were placed under a large bell jar, and a small quantity of sulphurous oxide thrown in, and in less than one minute all the litmus was turned red. In another experiment on letters, newspapers, etc., having been perforated in the manner that is practised at the fumigating station at Waycross, Ga., each package having several pieces of litmus placed in the centre, exposure for twenty-four hours was made, and but little effect was observed. The litmus that had been perforated showed a slight discoloration around the point of puncture. Sulphurous oxide accomplished it in a few minutes.

"The micro-organisms that were exposed were recent cultivations of anthrax, yellow-fever (Finlay), typhoid-fever, Asiatic cholera, and cholera nostras, the nutriment medium being agar-agar. All the cultivations were made in shallow dishes about an inch and a half deep and three inches in diameter. These were classed in several series, the same as was done with the test-tubes,

covered as follows: series 1, of anthrax, typhoid, cholera Asiatica, cholera nostras, and yellow-fever, covers of dishes removed; series 2, covered with filter-paper, dry; series 3, covered with muslin, dry; series 4, covered with flannel, dry; series 5, covered with a thin layer of absorbent cotton.

"These were exposed for twenty-four hours, then examined. In the dishes that were left open was found a certain, quite a considerable, quantity of phosphorous acid, and all the germs were found to be killed. In those that were covered with paper, etc., no change was noted, and inoculations from them showed all to be alive. Each cultivation was also tested for the presence of the acid in the medium, but in no instance was it to be found.

"These experiments were made several times, always with the same results. An attempt was also made to force the fumes of the acid through absorbent cotton, using for the purpose a large glass cylinder loosely packed with cotton. One hundred and twenty-five grams pressure was made, but none of the fumes came through it. This was readily accomplished with sulphurous oxide.

"Our conclusions are that the phosphorus pentoxide is a surface disinfectant *only*, having little if any penetrating-power, and is wholly unfit for fumigation and disinfection where penetration is desirable; that its limited scope of usefulness is altogether met in the use of bichloride of mercury. No observations on the spores of micro-organisms were made, as it gave negative results in fresh cultivations of the different germs tested."

HEALTH MATTERS.

Wounds of the Abdomen.

WE mentioned in a recent number of *Science* a suggestion made by Professor Senn of the use of injections of hydrogen-gas into the intestines to detect the presence of perforations in cases of gunshot or stab wounds of the abdomen. Professor Senn demonstrated the practicability of this method upon dogs, but, we believe, had no opportunity of applying it to the human species. Since then the method has been used in several cases with success. Dr. Mackie of Milwaukee, in the *Medical News*, reports its use in a pistol-shot wound of the abdomen. His method is thus described: "The patient was etherized, and rectal insufflation effected in the following manner. A four-gallon rubber bag, filled with hydrogen-gas, was connected by rubber tubing with the long glass tube of an extemporized chemical wash-bottle half filled with water. To the short glass tube, passing through the cork only, was attached, by rubber tubing, the rectal nozzle of an enema syringe. This bottle was introduced so that the rapidity of inflation could be judged of by the bubbling of the gas through the water. When the rectal nozzle had been introduced, slow, steady, and continuous pressure was made on the rubber bag. Under very slight pressure, the gas commenced to bubble through the water. As inflation progressed, the abdomen, previously flat on percussion from the umbilicus to pubes, became resonant, and the area of liver-dulness diminished from below upward. The inflation was continued until the abdomen became uniformly distended and tympanitic throughout. Still no gas escaped through the wound of entrance, although kept at the highest level. On firmly compressing the abdomen, there occurred an intermittent escape of gas mixed with blood through the wound of entrance. To demonstrate the presence of hydrogen by ignition of the escaping gas, matches were employed. These proved very unsatisfactory, for a burning match never once happened to be directly over the wound of entrance when the gas was escaping. The taper, as used by Senn in his experiments, had, in the hurry of preparation, been overlooked. The escape of gas from the wound of entrance positively proved that the gastro-intestinal canal had been injured, so that further attempts at ignition were superfluous."

In concluding the report of this case, Dr. Mackie says that it was impossible to diagnose, from the symptoms, perforation of the gastro-intestinal canal. The position of the wound of entrance, and the character of the vomit, were presumptive of injury to the stomach. The general direction of the bullet, and the position of the wound of exit, pointed to injury of the descending colon or kidney: still both were intact. The symptoms of intra-abdominal hemorrhage were not so marked as to justify a laparotomy.

The escape of gas from the wound of entrance, after rectal insufflation of hydrogen-gas, afforded positive evidence of perforation existing somewhere in the gastro-intestinal canal, and on this evidence alone was laparotomy performed. The perforations were so situated as to put this diagnostic measure to the severest test. It was found reliable, and further experience will prove that it is as infallible in the human subject as Senn has found it in animals. It never once failed.

In conclusion, we come to the medico-legal aspect of this case. The man who did the shooting has been committed for trial. The symptoms present were only presumptive of the existence of perforation, until rectal insufflation was made. Had an exploratory laparotomy been performed with the above fatal result, and no intra-abdominal lesions sufficient to warrant such a grave operation been found, the position of the surgeon would have been very embarrassing. The defence might affirm that the surgeon ought to be held responsible for the patient's death, and not the defendant. Naturally, this would deter one from operating; but if the surgeon can demonstrate, by rectal insufflation of hydrogen-gas, the presence of diffuse tympanites due to escape of gas through a perforation into the peritoneal cavity, even without the escape of gas through the external wound, he may rest assured that perforation exists somewhere in the gastro-intestinal canal, and he can then safely proceed to the necessary operative treatment without incurring any medico-legal responsibility.

Dr. William J. Taylor, in the same journal, reports the successful use of this means of diagnosis in another case.

ANTISEPTIC AMMUNITION. — According to the *Medical Press* of May 9, a useful suggestion is being carried out by the Netherlands Government, by which provision will be made for supplying each soldier, during the time of war, with a cartridge containing some antiseptic dressings. Each cartridge will be made of convenient size, namely, about three inches in length by two in width, and will be secured at one end with a safety-pin. The dressing contained in each will consist of a bandage about three yards long, and two pieces of gauze, all of which have been rendered antiseptic by a sublimate solution. Hence, in the event of wounds being received, a ready means would be at hand for the immediate application of antiseptic dressings. Soldiers, in the case of slight injuries, would probably at once avail themselves of the dressings, and the latter could not fail to be of much use to the surgeons. The idea is well worthy of the attention of the military authorities in this country, and might even with advantage be adopted, as it has been for years past in the German army. In the wars in which, during the past few years, England has been engaged in tropical climates, the early application of antiseptics to the wounds received by the men was admitted to be a matter of the utmost importance by the army medical officers attached to the forces.

A MEDICO-LEGAL CASE. — The following case of suicide, which recently occurred in Jamaica, presents features of considerable interest and no little importance. A colored man, after murdering his sweetheart, entered his house, and cut his throat with a razor. Some of the neighbors who had witnessed both deeds rushed into the house, but were unable to find him. After a search, his dead body was found under the house, which was a small one, built on supports, raising it about two feet from the ground. After cutting his throat, the man must have walked or run to the back entrance, a distance of sixteen feet, and then have crept through a hole in the partition, and have crawled on all-fours to the spot where his body was found, exactly beneath the room where he cut his throat, and therefore a further distance of sixteen feet. The throat was cut from ear to ear by a clean sweep, both carotids and jugulars being severed, as well as the trachea and œsophagus, the wound reaching back to the anterior portions of the bodies of the cervical vertebrae. A blood-stained razor, which was deeply notched, was found in the room, and marks of blood were traced from the room to the back entrance, by which the man must have gone out. Remarkable instances of the retention of voluntary power after wounds of the carotid artery, have been occasionally recorded; but *The British Medical Journal*, June 30, in commenting on the case, says that they know of no occasion on which the vessels on both sides of the neck

were divided, where so much power was retained by the subject of the injuries as in the present instance. The case should serve as a perpetual warning to medical men not to be too dogmatic as to what is, and what is not, possible, even in the presence of the most rapidly fatal wound.

VACCINE VS. BOVINE VIRUS. — The fear of contracting disease has to a great extent done away with the use of vaccine virus taken from the arm of a vaccinated child, and caused physicians, oftentimes against their judgment, to confine themselves to bovine virus. That this latter virus is not always innocuous is well shown by a report of the Royal Bureau of Hygiene at Berlin. Virus which was obtained from a vaccine-farm at Eberfeld produced in those who were vaccinated with it eruptions of the skin, and in some instances pustules formed. Among children, several deaths occurred. In one of these cases post-mortem examination revealed an abscess. Considerable constitutional disturbance followed the occurrence of the eruptions. Contagion seemed to be promoted by schools and the occurrence of the harvest. By order of the government, the vaccine-farm was temporarily suspended, all instruments and appliances were destroyed, the buildings most thoroughly disinfected, and the heifers destroyed. Vaccine-lymph subsequently produced at this farm was excellent in its results. The physician in charge sent a specimen of lymph to Berlin for examination. The microscope showed isolated bacilli, and numerous micrococci which multiplied in chains and did not liquefy gelatine. No control experiments by inoculation were made.

THE MICROBE OF DYSENTERY. — Chantemesse and Widal report the discovery of a specific bacterium in dysentery (*Progrès Médical*, April 21, 1888). Working in Cornil's laboratory, they have studied five cases of tropical dysentery, and have found the same microbe in the lesions and stools of a fatal case and in the stools of four others. The bacteria were found in colonies in and between the tubular glands of the intestine, in the lymph-glands, and spleen. The organisms develop rapidly at the ordinary temperature, thriving on all the usual culture media. They are bacilli, with rounded ends, and somewhat thicker in the middle than toward the extremities. They grow luxuriantly in sterilized water from the Seine. Fed to guinea-pigs, pure cultures produce intestinal inflammation and necrosis, the stomach itself being affected. The lesions are more marked when the gastric contents are rendered alkaline. Intraperitoneal injections cause death in two or three days with peritonitis, pleuritis, and pericarditis. The liver is affected in these animals, necroses with colonies of bacilli being found in the portal areas. All the lesions in the experimental cases furnished pure cultures of the bacillus. From these facts, and the absence of the bacillus in the fæces of healthy men, Chantemesse and Widal feel justified in claiming specific properties for this bacillus. In commenting on this paper, the *Medical News* says, that, although the observations made are too few in number to bring absolute proof, they are of interest as being the first in which so much has been accomplished. Numerous other investigators have described micro-organisms in dysentery; but none, up to this time, have succeeded in cultivating them. Further developments will be awaited with interest.

ELECTRICAL SCIENCE.

The Danger of Alternating Currents.

THERE has been a warm discussion before the Board of Electrical Control in New York as to the relative danger of continuous and alternating electric currents. Communications, most of them of a partisan nature, have been addressed to the board, and statements of a directly contradictory character have been made. Mr. Harold P. Brown, who champions the continuous-current side, has put the matter to a practical test by experiments tried at Columbia College July 30 and Aug. 3. He has killed a number of dogs, using both types of current, and he draws the conclusion that the alternating current is much the more dangerous. On July 30 only one dog was experimented on. The continuous current was first tried, the electro-motive force being increased from 300 to 1,000 volts, and the result was not fatal; then an alternating

current of 330 volts was turned on, and the dog was killed. Further experiments were prevented by an agent of the Society for the Prevention of Cruelty to Animals. This was unfortunate, as the result was distinctly unfair to the alternating side of the question, since a dog that had been subjected to a 1,000-volt continuous current was hardly in condition to stand very much more, no matter under what form the shock came. On Aug. 3, however, the experiments were repeated on a number of dogs, before Dr. Cyrus Edson and a number of physicians and electricians. The main results are embodied in the letter to *Science* published Aug. 10. In this letter three cases are mentioned, in each of which a strong and healthy dog was killed by alternating currents whose voltage varied from 340.5 (the highest) to 234 (the lowest). In some further experiments given by Mr. Brown in the *Electrical World*, a number of dogs were killed by alternating and by continuous currents. The maximum alternating-current voltage that was taken without death resulting was 500; continuous-current, 1,420 volts. Minimum alternating current that caused death was at 188 volts; continuous current, 800 volts. The physicians present expressed the opinion that a current which killed a dog would be fatal to a man under similar conditions.

If these experiments were conclusive, they would mean that alternating currents would destroy life at less than half the voltage that would make continuous currents dangerous. This is partly due to the fact, that when we measure alternating electro-motive forces by a Cardew voltmeter, such as was used in Mr. Brown's experiments, we measure the mean, not the maximum, electro-motive force; which last is, very roughly, half again as much. Still, as we always consider the mean electro-motive force, and as the alternating system uses a mean electro-motive force of 1,000 or 2,000 volts, whichever it may happen to be, we must drop the distinction between mean and maximum, or we must carry it into our practical work. Both these experiments are contradicted by the statements of various people that they have taken alternating electro-motive forces as high as 1,000 volts without inconvenience. Still, until these statements are more definite as to the conditions under which the shocks were taken, we may consider that Mr. Brown has the upper hand.

But, whatever may be thought of Mr. Brown's experiments on dogs, they add to the evidence pointing to the fact that an alternating current of 1,000 volts electro-motive force would be fatal. Such a pressure is far above the limit set by M. d'Arsonval, and few fair-minded persons will doubt its danger. This being the case, the question arises, Should a system using such a pressure be allowed for house-to-house distribution in crowded cities? Under certain circumstances, this could be safely done; under others it could not. If the wires can be taken over head, and if the converters may be placed on poles in front of the houses, the low-pressure secondary circuit alone entering the house, then the system, if properly installed, is reasonably safe, and should not be objected to on that score. If it is necessary, on the other hand, to put the wires under ground, and to bring them into houses to supply converters in the cellar, say, then the system is not safe, nor will it be economical; for the trouble and expense of keeping a network of high-potential mains in order, leaving out the danger, will take from the economy and popularity of the system. The rational and safe way of using the system, in a city where overhead wires are not allowed, is to have a number of sub-stations in the district to be lighted, to which the high-potential mains are taken, and from which current is distributed to the houses at a low potential. On this latter plan, there is no reason that the system should not be used in New York or anywhere else. The high-potential conductors are less dangerous than the arc-light circuits; for they are tapped at fewer places, and the current is not taken into any house at a pressure high enough to cause death. It is, in fact, the only safe method of alternating-current distribution under ground. We hope that it will be tried, and that it will succeed.

A NEW ELECTRO-DYNAMOMETER. — M. Pellat has devised an electro-dynamometer which seems sensitive, and whose constant may be determined with accuracy from measurements. It consists of two cylindrical coils of wire, one within the other. The axis of the longer and larger one is horizontal, that of the smaller is ver-

tical, and the two axes intersect at their middle points. If, now, a current be sent through the coils, — the outer one being fixed, the inner movable, — the axis of the latter will tend to place itself parallel to that of the former. The smaller coil is at one end of a scale-beam, and its tendency to move is balanced by weights added to the pan at the other end. The current is calculated from the weight in the pan and the dimensions of the two coils, the latter being in the form of a constant. The current is conducted to the inner coil by two silver wires joining the support with terminals on the scale-beam, to which the ends of the coil are taken. The two most difficult measurements that have to be made are the diameter of the cylindrical coils and the distance apart of the turns of wire. The former, M. Pellat states, can be made with an accuracy of 1 part in 5,000; the latter, within 1 in 3,000; and, as we measure the square of the current, the last error would only appear as 1 in 6,000 in the result. In discussing all the sources of error, M. Pellat reaches the conclusion that the results of measurements are correct to at least 1 part in 2,000. The currents that can be measured are not greater than .6 or .8 of an ampère, the difficulty lying in the fact that in getting the current to the inner coil very fine wires must be used in connecting the stationary with the movable parts, otherwise the sensitiveness will be decreased. To allow for the effect of the earth's magnetism, the current is sent first in one direction, then in the other. The difference in the weighings is due to the magnetism of the earth. In calculating the current from a weighing, we have very simply $i = A \sqrt{p}$, where A is a constant calculated from the dimensions of the instrument, and p is the weight in the scale-pan. The sensitiveness of the instrument allows measurements to be taken within 1 in 10,000. M. Pellat proposes to use this instrument for calibrating other current-measuring apparatus, for measuring electro-motive force (using it in connection with a resistance), and for determining the horizontal component of the earth's magnetism (employing it with a tangent galvanometer).

A LIGHT-WEIGHT PRIMARY BATTERY. — In France M. Renard has experimented for some time past on a navigable balloon. In order to obtain the power necessary to direct it, he has attempted to find an electric battery that is very light for its output, the question of economy not entering. None of the primary or secondary batteries in use would answer his purpose, and a new one had to be invented. After a number of experiments, he found that the best results were obtained by a cell in which the metals were zinc and platinized silver, while the liquid was a mixture of hydrochloric and chromic acids. The liquid is not very stable, but it can be kept for several days if it is not exposed to light. There is no local action in the cell if the chromic acid in the solution does not fall below one-seventieth of the equivalent for the hydrochloric acid present. The cells are made tube-shaped, the diameter being about one-tenth of the height. The potential is 1.2 volts; and from cells weighing thirty-three pounds, 200 to 250 watts per second have been taken for two hours and a half. For a storage-battery of the same weight, the energy could not be taken out at a rate of more than 75 or 100 watts, and this at a low efficiency.

MENTAL SCIENCE.

The Effect of Practice upon Reading.

INASMUCH as all education is in essence mind-building reduced to an art, the strictly psychological study of mental phenomena must in the end yield results of high practical import. It is this conviction that has brought the psychologist and the educator into such close sympathy, and has brought the latter to eagerly await the results of the former's somewhat specialized and technical studies. To no topic is this more applicable than to the study of the times taken up by various simple psychic processes, and of the causes influencing such times. We here touch upon the very powers that the teacher aims to develop, and, if we can acquire a method of testing these powers, we are sure to learn more of their real nature. A very promising contribution in this direction has been recently published by Dr. G. O. Berger (*Philosophische Studien*, v. 1), an account of which will probably be of interest to American students.

Dr. Berger measured the time needed by the boys of the different classes of a German Gymnasium to read a given Latin passage. It will be remembered that the Gymnasium consists of six classes, or, as the three highest classes are each divided into two, of nine classes; and that the study of Latin is begun upon entering the school, and is continued with great zeal throughout the nine-years' course. The five scholars with the highest and the five with the lowest standing were chosen from each class. The average ages of these groups of ten scholars from the nine classes were 10.7, 12.0, 12.9, 14.2, 15.2, 16.4, 18.0, 18.6, and 21.6 years. The class preparatory to the Gymnasium was also tested, the average age of the boys being nine years. These last boys had no Latin instruction. Each Gymnasium scholar read (1) the first hundred words from Tacitus' 'Agricola' (Chapter I.), as well as (2) the next five hundred words, as rapidly as possible, with some sacrifice of distinctness, and (3) he again read the first hundred words with normal rapidity. The average number of seconds necessary to read a hundred words by the three tests for the boys of each class is as follows:—

Class.	VII.	VI.	V.	IV.	III b.	III a.	II b.	II a.	I b.	I a.
(1)	262	135	100	84	79	57	54	49	48	43
(2)	—	145	104	93	83	59	58	53	53	45
(3)	—	134	95	84	79	61	56	57	53	52

We see at once that the higher the class, the less time does it take for the boys to read Latin, and that this shortening of the time is in conformity with the general law of practice,—at first rapid, and then slower and slower. We see, too, that the most decided difference is between the boys who have had no Latin instruction and those who have just been initiated into its mysteries. The numbers in the second line are larger than in the first, indicating the difficulty of retaining this speed for a longer time. The differences are less as the boys are older, showing that the older boys have greater facility at protracted rapid reading. A similar test with Goethe's 'Egmont' (v. 2) resulted as follows:—

Class.	VII.	VI.	V.	IV.	III b.	III a.	II b.	II a.	I b.	I a.
(1)	72	55	43	37	39	28	27	26	25	23
(2)	—	56	43	39	40	30	28	26	27	24
(3)	—	48	40	39	41	33	30	33	30	30

The comparison of this table with the foregoing shows (1) the great difference in time due to the familiarity and comprehension of the vernacular; (2) that the additional effort needed to read five hundred German words is less than in the case of Latin; (3) that the great difference between VI. and VII. disappears, because all the boys are acquainted with German; and (4) that the curve of practice is generically the same in the two cases. A point of great interest, applicable to both languages, is that the difference between (1) and (3) is greatest with the older boys: in other words, when these read normally, they read for the sense, and thus slowly, while the younger boys read more mechanically. The familiarity of the passage, due to its being read a second time, even makes (3) shorter than (1).

To obviate the objection that this shortening of the time is due to a general quickening of the intellectual activities, and not to a practice in Latin, Dr. Berger tested the boys by measuring the times neces-

Class.	VI.	V.	IV.	III b.	III a.	II b.	II a.	I b.	I a.
(1) 5 colors	83	66	79	66	63	56	63	63	54
(2) 10 colors	135	99	119	123	100	91	112	99	86

sary for them to name (1) any one of a group of five or (2) of ten colors, as the above table shows this exercise, in which they

have had no special practice, while exhibiting differences due to age does not at all correspond with the former differences.

The interesting point is to determine the nature of the psychic process by which this quickening of the process is brought about. If we divide the time consumed in reading into (1) the time for the impression to reach the retina and the brain, (2) that for recognizing it and calling up the appropriate sound-image, and (3) that for setting the vocal apparatus in working order, we recognize in (2) the important psychic factor. Previous experiments as well as ordinary observation have shown that the unit in reading is not the letter, but the word (adults reading a word almost as fast as a letter); that, furthermore, all the three processes overlap in time, and that the eye goes ahead of the voice. If the words are in construction, we can take in more of them at a glance, and so read faster. In the following table the first line, taken from the table above, gives the time for reading a hundred German words forming sense; the second line, the time for reading a hundred words not rationally connected.

Class.	VI.	V.	IV.	III b.	III a.	II b.	II a.	I b.	I a.
100 words in construction	55	43	37	39	28	27	26	25	23
100 words not in construction	60	50	49	48	41	38	37	38	32

The nature of the errors in reading, likewise points to a difference in the number of words grasped at one time. The youngest boys of class VII. misread letters or syllables, such as *eitra* for *citra*. Class VI. were more apt to mistake one word for another, *æstas* for *ætas*. The older boys misread sentences, but not so as to interfere with the sense. The shortening would thus be due to reading more and more words as wholes, and not as combinations of syllables. This can be verified thus: taking the classes by groups of three, the average times needed to read a hundred words in construction is, from the last table, 45, 31.3, 24.6 seconds; for disconnected words, 53, 42.3, 35.6 seconds; and the ratios of these pairs of numbers are 1.18, 1.35, 1.45, an increasing series. This means that the older boys profit more by having the words in construction than the younger ones. The same can be observed in the difference between the rapid and the normal reading of Latin, as noted above. The effect would be more noticeable in the case of Latin, for here at first the words are almost all mere sound-signs without associations with one another.

Dr. Berger then concludes (1) that the effect of practice is greatest upon the central psychic portion of the reading process; and (2) that it acts by increasing the scope of the mind, enabling it to take in more complex impressions as units, and enlarging the number of, as well as the associative links between, the impressions.

THE EFFECT OF STIMULANTS UPON THE RE-ACTION TIME.

—Dr. Dehio (*Neurologisches Centralblatt*, Feb. 15) injected a dose of coffee in the form of caffeine subcutaneously, and administered tea containing 1.5 per cent of theine, and with the subject under the influence of the drug measured his re-action time, and the times necessary for simple psychic processes. He found that the simple re-action time tended to become shorter in the drugged than in the normal condition; the time necessary to choose between several modes of re-action (choice-time) was not affected one way or the other; while the time needed to find an association for a word or similar process was shortened and the variations in the times reduced under the influence of coffee, and was at first shortened and then lengthened under tea. This double effect of shortening followed by lengthening is also shown under alcohol, but alcohol affects the choice-time, while tea does not. Again: in the apperceptive processes the shortened times under tea last for some time before the lengthening sets in, while the corresponding period is brief with alcohol. The general effect of alcohol is to excite, while tea induces fatigue.

BOOK-REVIEWS.

Logic; or, The Morphology of Knowledge. By BERNARD BOSANQUET. 2 vols. Oxford, Clarendon Pr. 8°. (New York, Macmillan, \$5.25.)

THIS work is an attempt to reconstruct the science of logic. The author is attached to the German school of philosophy, and acknowledges his obligations to Kant, Lotze, and Hegel. The work is divided into two parts, the first and larger part treating of judgment; the second, of inference. Mr. Bosanquet holds that the function of the intellect is always the same, whether in conception, judgment, or reasoning, and consequently that the common logic, which treats these as distinct forms of thought, is all wrong. Judgment he regards as the fundamental form of thought, the other so-called forms being either varieties of this or included in it. He recognizes the difference between judgment and inference, and defines the former as the immediate reference of an idea to reality, while in the latter this reference to reality is made mediately. One consequence of this theory of the intellectual functions is, that the author does not clearly distinguish the different parts of his subject, and treats some of them insufficiently. Thus, he holds that conception takes place only in an act of judgment; and hence he gives but little attention to conception as such, and leaves us in great doubt as to what his views of it are. Some other topics, too, that fill a large space in the common treatises, receive but scant notice in this work. The syllogism, for instance, is not treated systematically until the last chapter but one, and then it is rather discussed and criticised than elucidated. On the other hand, some subjects are introduced, such as the nature of infinity, which are not usually treated in logical works.

It will be seen, therefore, that Mr. Bosanquet's work differs quite largely from what he calls 'the traditional logic.' What is the real value of his theories we shall not undertake in this brief review to say, though they do not appear to us so original as the form and phraseology in which they are expressed might appear to indicate. But the work is suggestive, both as a whole and in special passages, and will doubtless give rise to much discussion. The contribution of an individual thinker to any branch of philosophy often consists, not in the discovery of new principles, but in the adoption of a new point of view; and this merit the treatise before us unquestionably has.

But, whatever may be the ultimate verdict on Mr. Bosanquet's theories, it is impossible not to condemn his style, which is one of the most obscure in English literature. Take, for instance, the following sentence at the beginning of the chapter on modality: "Modality, if it exists at all, is simply the degree in which individual judgments participate in the certainty of that permanent and all-embracing judgment by which the individual intelligence sustains those qualifications of the real which for it constitute reality." This is an extreme case; but there are many other passages scattered through the work that are not much more intelligible. Moreover, the author uses some phrases, such as 'really real,' and 'the ideal fabric of reality,' which to our mind convey no meaning at all. If the new logic is to become popular, it will have to express itself in plainer terms than these.

Sound, Light, and Heat. By MARK R. WRIGHT. London and New York, Longmans, Green, & Co. 12°. 80 cents.

THIS text-book by the head master of the Higher Grade School, Gateshead, a manufacturing town in the county of Durham, England, is one that will prove very suggestive to the teacher of elementary physics in our schools and colleges. It is written in a somewhat categorical style, and might prove wearisome in the classroom; but wherever it is possible to have this book at hand while performing the readily carried out experiments, it will surely prove a valuable guide. In addition to the numerous experiments, which the author deems it essential should be performed, numerous examples are introduced, the author's belief being that "science has been slow in following arithmetic in this matter." The object is to induce the student to gain by experiment, always recognizing the limitations set to the accuracy of his work, such results as he may be able to use in the solution of the problems set. The experiments demand no very large supply of apparatus, descriptions of

that used being given either with the text or in the appendix. Little space is given to theoretical considerations, "a beginner's time being best spent in examining the facts of science," which facts are set down, as said above, in possibly too categorical fashion to please all.

The Spirit of Beauty. Essays Scientific and Aesthetic. By HENRY W. PARKER. New York, John B. Alden. 12°.

THE intelligent reader will wonder that the same author had written the first and the last essays in this work, so great is the difference between them in their real scientific conception. The first three chapters, making more than half the volume, have some scientific interest and value; rather, however, as criticism than as a contribution to the subject. They discuss the evolution of the beautiful, mind in animals, and the moral in nature. The author is a naturalist, and is quite familiar with the facts and views of Darwin, Spencer, and Haeckel; and whatever restrictions he may make upon them, he has made as a man who has studied the subject from the inside. But the important criticism to pass upon his strictures of evolution is, that it is the complaint of a mind which has not the courage to reconcile itself with the new environment which that doctrine has created. It is an illustration of that wide and revolutionary influence upon human thought which Darwinism will exercise, when, like the theory of gravitation, it has penetrated the lower intellectual strata of life. The observation of facts in the organic and inorganic worlds is good; the appreciation of the realistic tendencies of science is clear enough; but the reflection of sentiments and beliefs from an earlier period fortifies the judgment against taking in the full scope of the conclusions of the scientific spirit. Every thing is admitted, and even asserted as undeniable fact, except the one thing needed to give these chapters a strictly scientific value. The bias of preconceived opinions comes in to intrude views that are irrelevant, as well as doubtful and unimportant. Yet we could heartily recommend this part of the author's work to amateurs who want some criticism and interpretation along with their facts, and who wish to move cautiously amid the bewildering maze of phenomena presented in the study of animal life. The scientist will derive less benefit from it, but he will not find it without value.

It is in the last two essays, on the rainbow and life transfigured, that the most singular part of the work presents itself. It is allegory and mysticism,—the antipodes of science. They are conceived after the manner of Drummond's 'Natural Law in the Spiritual World.' They are worth noting as illustrations of that peculiar psychological constitution which is partly due to the education and prevailing beliefs before Darwinism appeared, and partly to that persistent tendency in many minds to mistake a feeling for a fact, a subjective experience for an objective reality. They may do to suggest æsthetic ideas; but it is as great a mistake to pursue the emotions aroused by beautiful analogies as if they were facts, as it is to look at poetry as science. Both science and art are the losers by it. We believe the book would be of more value without these chapters. It would certainly exercise a greater influence upon the scientifically disposed mind. The author should not have made the attempt to combine æsthetics and science in his discussion. The analysis and classification of phenomena, and the investigation of causes, are an encumbrance to æsthetics, because art is content with the relations of things, and is not interested in their explanation. Ruskin would not have committed this error; and the author is an admirer of that great art-critic.

How to study Geography. By FRANCIS W. PARKER. Englewood, Ill., The Author. 12°.

FOR a number of years the attention of geographers has been directed to improving the methods of teaching geography. This movement originated in Germany. Since the rapid growth of the science of geography, the necessity has been felt of including it in the course of studies of the universities. Towards 1870 professors of geography were appointed at various universities, and at present it is taught at all the great German universities. Most of the students who studied geography became, in course of time, teachers at higher schools; and thus a class of educationists, well versed in the science of geography, grew up, and to these we owe the fun-

damental reform of the methods of teaching geography. Most of the scientists who were appointed professors were originally not well acquainted with the needs of the Gymnasium and of other higher schools. They were so much engrossed by their subject as to be too exacting in their demands upon the pupil. These excessive demands, however, found their corrective when their students became experienced teachers. Thus the methods of teaching geography, after about twenty years of discussion, have been established on a firm and sound basis.

While material progress was thus being made in Germany, England and America had not even made the slightest attempt to bring about the much-needed improvement in the teaching of geography. A few years ago the attention of the Royal Geographical Society was called to this subject, and a thorough study of the methods used on the continent, particularly in Germany, was published. Here, also, the movement began among scientists, not among teachers; and therefore we observe again that too much was asked for. Since that time the movement has reached the schools, and innumerable attempts have been made to find a 'royal road' to the knowledge of geography. We may divide these into two classes: the first embracing suggestions of geographers or geologists; the second, those of teachers. While among the first class we find highly suggestive books which show that geography might be made the foundation of teaching natural science, they are deficient in not being written by experienced teachers. The second class shows the sad lack of trained teachers of geography, and the necessity that a reform of the teaching of geography must begin with training teachers.

Recently a number of valuable books have been published in England, but in America little has been done. Text-book after text-book and map after map are being published, but the new ones are in no way superior to the preceding ones. Since Guyot imported Ritter's ideas of geography into this country, the study has continued to move on this line, wherever it was more than mere memorizing of names. That geography which has recently developed in Europe has not reached our continent; the tendency here being to cultivate all the sciences contiguous to geography, while the complex geographical phenomenon does not attract the attention of the American scientist.

It seems to us that Parker's book marks a new step in the development of geography in our country. It is the first time that a leading educationist tries to solve the question how to study geography, and gives it its proper place in the course of study. Although not a geographer himself, and although a number of his statements are not in correspondence with the views held by geographers nowadays, he has a true conception of the ultimate aim of geography. "The study of geography, elementary and scientific, cultivates systematically the faculty of imagination, and the products of this faculty arouse and develop at every step emotions of beauty that culminate in the emotion of grandeur. The mentally pictured hill is 'a thing of beauty,' which, in time, towers up into the grand image of the lofty mountain. The lake is the inception of a picture of 'old ocean's solitary waste.' Gradually, under skilful teaching, hills, mountains, and plains, oceans and continents, are united in one sublime image of the round world. Life-bearing and life-giving, it stands out before the exalted imagination." This view is fundamental in giving geography its proper place in school and in life. It is not the sole object of geography to analyze observations, and thus to train the mental power of the child, although it is well adapted to this purpose: its more important function is to train the imagination and the power of feeling, to bring home the grand truth of the unity of nature.

This being the concept of the book, Parker omits physiography, which is the favorite subject of many writers of school-geographies, altogether, and defines geography as purely and simply a description of the earth's surface; and the primary purpose of teaching geography, to develop in the pupil's mind a concept corresponding to the earth's surface.

The book opens with a general introduction on the aim and scope of teaching geography. This is followed by a chapter intended to aid teachers in laying out their plans for teaching. The third part is an outline of a course of study of elementary geography, which is followed by very interesting directions and suggestions.

The rest of the book is taken up by notes on the course of study. We do not intend to enter into the details of this plan, but confine ourselves to a few remarks. Parker's directions on the use of maps ought to be read and borne in mind by every teacher. There are very few persons who are able to interpret a map; and teachers ought to bear in mind constantly the fact that the map only represents part of the earth's surface, and that its object in teaching is exclusively to convey the concept corresponding to the country it represents. In order to reach this end, Parker strongly advocates moulding and the use of relief-maps, although he is aware of the serious objections raised to this method. Until better school-maps are provided, it will be impossible to dispense with this means of teaching.

The course of study which he recommends begins, of course, with systematic observations of nature, of the surroundings of the child. Thus the concepts of the natural features and elements of land and water are gained; and, these once obtained, he rightly turns at once to considering the widest generalizations, the continents, and works the detail into their general outline. It may seem doubtful whether his widest generalizations, slopes and river-basins, are the best from a geographical point of view. He considers the continents as formed of a short and long slope, and next subdivides the slopes and adds the necessary detail. This method fails in the case of Africa, and seems undesirable in teaching the geography of North America and Asia and their large plateaus. But Parker himself does not consider the course suggested in his book as final. There will probably be much discussion regarding detail, and on the important question, 'In how far, if the principal generalizations are derived from form, should the origin and development of that form be considered?' But a careful study of this important book will not fail to exert a most wholesome influence upon the progress of geography in our schools, and it may be that it will open the road to that science of geography which has so far hardly any representatives in America.

The History of Protective Tariff Laws. By R. W. THOMPSON. Chicago, R. S. Peale & Co.

THIS book is not to be taken seriously as a history of the tariff. Of independent or original historical investigation there is hardly a trace. There is nowhere any reference to the author's source of information; nor, indeed, is this necessary for the sort of information he gives. We are told in the volume chiefly about the opinions which various statesmen have held at one time or another on the tariff, — the sort of historical knowledge which can be got readily enough by glancing through files of presidential messages and of the congressional debates. Even this information, whose value is dubious enough at best, is distorted and worthless. One would imagine, from Mr. Thompson's quotations and copious Italics, that all the statesmen we ever had were the stiffest of protectionists. Of other information there is very little. Various tariff acts are described in the vaguest way, so that the reader is unable to guess what the general range of duties under them was, still less what was the duty on any particular article. There is no pretence of investigation of economic history, of the development of protected industries, of the difficult and perhaps insoluble problem as to the effect of protective duties on general prosperity.

In fact, Mr. Thompson writes, not a history, but a voluminous campaign pamphlet. That he has a strong bias (to put it mildly) for protection, is not inconsistent with his doing good historical work, even though not the best. But he has done no such work, and the student of history will turn over his chapters with a sigh of disappointment. Nor will the book appeal to those who want solid and serious argument on the tariff controversy. The reasoning is of the most watery sort, and consists chiefly of vague paragraphs on industrial independence, the home market, the disastrous effects of importing more than we export, the designs of England, and what not. Only those who want campaign thunder would find any thing to their purpose; and they are not the sort to wade through 526 pages, when they can get their thunder in compact form, and gratis, from campaign committees. Mr. Thompson's history belongs to that class of books by public men which are bought for their title and their large print by respectable philistine families, and repose unread on scanty book-shelves.

History, at its best, cannot help us much in the tariff controversy. The crucial question as to the effect of protective duties on general prosperity eludes a specific answer. The tariff is but one of a thousand factors affecting the country's welfare, and by no means among the most important. Its effects are so covered and hidden by the effects of other causes, that it is practically impossible to follow them out to their end. There is no subject on which so much unwarranted nonsense is talked, on both sides, as on the question of protection. He who approaches it with so cock-sure an air as Mr. Thompson, and tells us glibly about the beneficent effect every high tariff has exercised, and about "the general embarrassment" which followed low duties, is, on the face of it, incompetent to tell us any thing worth listening to.

NOTES AND NEWS.

THE third number of the *Internationales Archiv für Ethnologie* is full of interesting material. The journal has rapidly become the principal source of information to those whose studies refer to ethnological collections. Each number contains beautifully engraved color-plates showing interesting specimens. The text gives elaborate descriptions of these plates, and reports of numerous museums; descriptions of important accessions, of the organization of the collections, and information regarding smaller collections, which would otherwise be inaccessible to the student. The last number contains a description of the extensive collection made by Adrian Jacobsen among the Golds and Gilyaks, and a description of the native tribes of Liberia. Besides this, it contains interesting reports of current literature, recent explorations, and new collections.

— The second annual meeting of the Iowa Association for Scientific Research was held at Des Moines, Io., Sept. 5 and 6. Among the papers presented were, 'Local Problems in Science' (presidential address), by Herbert Osborn; 'My Experience in rearing *Vanessa antiopa*,' by F. M. Witter; 'On the Sedentary Habits of *Platyceras*,' by Charles R. Keyes; 'On the Folding of Carboniferous Strata in South-western Iowa,' by J. E. Todd; 'Descriptions of New *Cynipidae*,' by B. T. Gillette; 'The Pustulate *Unionidae*,' by R. Ellsworth Call; 'The Fauna of the Lower Coal-Measures at Des Moines, Io.,' by Charles R. Keyes; 'The *Cicadidae* of Iowa,' by Herbert Osborn; 'The Lineage of Lake Agassiz,' by J. E. Todd; 'From the Stamen-Petal,' by B. D. Halsted; 'Some Additional Observations on the Loess in and about Muscatine,' by F. M. Witter; 'The Geology of Crowley's Ridge, Arkansas,' by R. Ellsworth Call; 'On the Glacial Drift and Loess of a Portion of the North-Central Basin of Iowa,' by Clement L. Webster; and 'Descriptions of Two New Fossils from the Devonian of Iowa,' by Charles R. Keyes.

— An Italian engineer, M. Bocca, has just finished estimates for a ship-canal to cross Italy. The canal would start from Castro on the Mediterranean Sea, and end at Fano on the Adriatic. The length would be 282 kilometres, the width 100 metres, and the depth 12 metres, allowing large ironclads to pass. The canal would drain Lakes Perugia and Bolsena, and would allow of a systematic irrigation of that whole region. The cost is estimated at \$100,000,000. The work would occupy 200,000 men for five years.

— Dr. M. Eschenhagen, in a recent number of *Petermann's Mitteilungen*, calls attention to an attempt to explain the magnetic polarity of the earth and the situation of the magnetic poles. The theory was first propounded by Dr. Menzzer. He assumes that electrical currents flowing from east to west cause the magnetic polarity of the earth. If the surface of the earth were solid, these currents which depend upon the rotation of the earth would run exactly east by west. This is approximately the case in the strata lying below the average depth of the ocean. In the highest layers, however, the distribution of land and water affects these currents. When entering the ocean, they cause a locomotion of the water, and thus the geographical features of the earth's surface affect the polarity of the globe. Eschenhagen shows by a simple construction what

this effect would be on the southern hemisphere. He assumes that there are no electrical currents whatever in the ocean, and computes the influence of those of the continents according to the size, shape, and position of the latter. The result of this computation shows that the magnetic pole would be situated in latitude 76° 50' south, and longitude 183° 48'. According to Ross, its position is latitude 75° 6' south, and longitude 171° 50'. As the influence of the Antarctic continent has not been included in this computation, the result must be considered very satisfactory and encouraging to further work on Menzzer's hypothesis.

— The *Political Science Quarterly* for September contains three articles on constitutional questions, the most important of them being that by Sydney G. Fisher on the 'Suspension of *Habeas Corpus* during the War of the Rebellion.' Mr. Fisher reviews the action of President Lincoln in suspending the *habeas corpus* by his own fiat, and, after considering the arguments on both sides, comes to the conclusion that such action by the executive authority was wholly unwarranted. The Constitution, in his opinion, gives the power to suspend the writ to Congress, and not to the President, and with this opinion we cordially agree. The subject is one of great importance, and it is unfortunate that the Supreme Court has never had the opportunity of passing judgment upon it, so as to settle the question authoritatively. Mr. William A. Dunning has a somewhat rambling article on the 'Inequality of the States,' in which he expresses the opinion, that, owing to certain conditions imposed by Congress at the time of reconstruction, some of the Southern States are not on an equality with their sisters. Mr. Dougherty's paper, on the 'Constitutions of the State of New York,' is the first of a series, and will interest the people of the State, and students of institutions elsewhere. Prof. R. M. Smith concludes his discussion of the immigration question, expressing himself strongly in favor of restriction; yet he has little to propose in the way of restrictive measures beyond the more rigid enforcement of existing laws. The article in the *Quarterly* that will be likely to attract most attention is the opening one, by George Gunton, on the 'Economic and Social Aspect of Trusts,' in which he takes the ground that these colossal combinations of capital "are the natural consequence of modern industrial differentiation, and in their nature are economically wholesome, and politically and socially harmless." He confines himself mainly to the economic aspect of the subject, and overlooks some important facts connected with it; but his essay will be useful as a corrective of extravagant and unintelligent views on the other side of the question. On the whole, this number of the *Quarterly* is one of the best that has yet appeared.

— Harper & Brothers have in preparation Sir J. W. Dawson's 'Modern Science in Bible Lands.' — E. & F. N. Spon have now ready the third edition of 'Dynamo-Electric Machinery: a Manual for Students of Electrotechnics,' by Silvanus P. Thompson. Most of this treatise has been re-written for this edition, and much new matter has been added. The same firm announces as ready Sept. 1, 'The Elements of Electric Lighting,' including electric generation, measurement, storage, and distribution, by Philip Atkinson. They also publish 'Crystal Models,' by John Gorham, and the second edition of 'Short Lectures to Electrical Artisans,' being a course of experimental lectures delivered to a practical audience, by J. A. Fleming. — The September issue of the *American Magazine* opens with an article on 'The American Navy of To-day,' by Lieut. William F. Fullam, U.S.N. A feature of the article is a description of Captain Zalinski's dynamite cruiser, the 'Vesuvius.' The new cruisers are fully described. — With the issue of Aug. 30, *Light, Heat, and Power* becomes a weekly journal. — The Electric Light Convention, just closed in New York, was the most largely attended meeting yet held by the association, and the papers, reports, discussions, and addresses were of unusual interest and importance. Although the business of the convention only came to a close late Friday afternoon, Aug. 31, *The Electrical World* was out on Saturday morning with its usual full, carefully prepared stenographic report of the proceedings. — Dr. McCook's 'Tenants of an Old Farm' (New York, Fords, Howard, & Hulbert), published at \$2.50, will be sold this season at \$1.50.

LETTERS TO THE EDITOR.

Exploration of the Xingu.

THE German explorers, Karl and Wilhelm von den Steinen, embarked in Rio de Janeiro, July 21, for Germany, after nearly a year spent among the Indians of Matto Grosso. The exploration of the Xingu in 1884 by the two Von den Steinens and Claus revealed the fact that in this region exist a number of tribes who are not acquainted with the existence of a white race, and who may literally be said to represent the primitive condition of the Brazilian Indians in the stone age and before the discovery of America. Furthermore, the diversity in the language of these tribes indicates a variety of ethnological groups, and offers a rare opportunity for studying the apparently insoluble riddle of the natural classification of the Brazilian aborigines. The importance of the results of the 1884 expedition, and still more those that might be expected from future work in such a promising field, led Dr. Karl von den Steinen, after the publication of his book, to resolve upon a new exploration, in which he was warmly seconded by European ethnologists. The new expedition, unlike the first, which was organized mainly with a view to geographical work, came prepared to give chief prominence to ethnology. Dr. Karl von den Steinen, who proposed to devote his attention principally to language-work, was accompanied by his cousin Wilhelm, one of the original Xingu party, as artist; Dr. Paul Ehrenreich, who had already made important ethnological studies in Brazil, as assistant ethnologist and photographer; and Dr. Peter Vogel as geographer and geologist.

Leaving Rio de Janeiro in February of last year, the party was delayed in ascending the Paraguay by the existence of cholera along that river, until the beginning of June, the interval being employed in an examination of the shell-heaps of Santa Catharina. The president of Matto Grosso furnished an escort of four soldiers under command of an ensign. Another ensign, who had accompanied in part the 1884 expedition, and had since retired from the service, joined the expedition as a volunteer. A civilized Bakairi Indian, Antonio, also of the 1884 party, was engaged as interpreter, making up, with the necessary *camaradas*, a party of fourteen. The expedition left Cuyaba July 28, the explorers on foot, and serving as occasion required as *peones*, trail-cutters, and oarsmen. Proceeding first to the Paranatinga, an affluent of the Tapajos, for whose exploration a party of Brazilian engineers was lately fitted out, several astronomical determinations were made about the head waters of that river. The party then marched to the north-east, passed the Batovy branch of the Xingu, explored in 1884, and on the 7th of September reached the Kuliseu, where a permanent camp was made for a portion of the party, that remained in charge of the animals and baggage, while the explorers descended the river in bark canoes made on the spot, to the confluence of the Kuliseu with the Batovy. The first Indians met with belonged to the Bakairi tribe, with whom, as the language was already known, communication was readily made, and with whom the explorers spent several weeks, accompanying them on their fishing and hunting excursions, in their agricultural labors (performed entirely with stone and wooden implements), in their festivities, and, in fact, in all the phases of their life. The next and most numerous tribe was the Nahuqua, who, like the Bakairi, belong to the Carib family, which is supposed by Dr. von den Steinen to have migrated northward to the Caribbean Sea from some point in Central Brazil. The Nahuqua have a number of villages on the Kuliseu and on the Kuluene, the principal branch of the Xingu, with which the former unites. The sudden arrival of a large party so alarmed these people, that it became very difficult to study them, and in consequence Dr. von den Steinen resolved to make his entry alone, or with only a small number of Indian companions, in the villages of the other tribes, in order to establish friendly relations before the arrival of the full party. This somewhat hazardous experiment was tried first with two completely savage Bakairi companions in a village of Mehinaku Indians, the only weapon carried being a revolver. The traveller was received by a tumultuous crowd of naked savages, shouting, brandishing bows and arrows, and beating their breasts, who seized him by the wrists, and with considerable violence led him to the central feast-house, where he was plumped down on a bench, and made the recipient of a shower of questions and of hos-

pitable presents of cakes and porridge. A German speech and sundry recitations from Goethe, delivered with hearty laughter, were accepted as a reply to the unintelligible questions, and friendly relations were soon established.

Other tribes are the Auatihu, Vaura and Kustenau, Yaualapiti, Camaiura, and Trumai. The Camaiura are true Tupi, and manifested great satisfaction on hearing the common names of plants and animals that have been incorporated in Portuguese. The Trumai, by their language and physique, differ markedly from all the other tribes. They had been met with in 1884, but the accidental discharge of a gun so alarmed them that no communication could be established. After that, they suffered greatly from the attacks of the Suya, a Botocudo tribe living lower down the river, and, retreating southward, were naturally greatly alarmed on meeting again the strangers with the thundering arms of the former encounter.

Returning to Cuyaba near the end of December, the travellers had an opportunity for studying the Pareci, and afterwards made an excursion to the river Sao Lourenço to examine the Bororo or Coroado. The Von den Steinens then descended the Paraguay, and spent some time examining the Indian remains in that province. Dr. Ehrenreich proceeded to Goyaz to descend the Araguaya to Para; and Dr. Vogel remained behind to explore geographically the highlands between the Paraguay and Parana, with the especial object of opening a road from the colony of Sao Lourenço to Santa Anna do Paranahiba, on the Parana, which was successfully accomplished.

The scientific results of the expedition far exceeded the most sanguine expectations. In a lecture before the Geographical Society of Rio de Janeiro, Dr. Karl von den Steinen presented the following general observations on the Indians of the upper Xingu.

As a rule, they are of low stature, but well proportioned and agile, of light clay color, with black hair, which is wavy in some individuals. The women wear the hair hanging loose to the shoulders: the men cut it in a circle about the base of the skull, and in some tribes shave the crown of the head. All the hairs of the face, including the eyebrows, and of the body, are carefully pulled out. The Trumai are distinguished from the others by a weaker physique and more brutal physiognomy. The only clothing worn is a triangular *tanga* of palm-leaves, "bigger than the eye, but not so big as the ear," used by the women. The body is smeared with coal-dust or oil colored with annatto. The houses, round or elliptical and high and airy, are generally built in a circle about a central feast-house, which is uninhabited, and into which the women are not permitted to enter. As a better safeguard against feminine curiosity, the entrance to this house is a mere hole less than a metre high. This structure is also used as a guest-house. The usual habitations serve for several families; the hammocks of palm-fibre, or cotton woven by hand between two stakes driven in the ground, being hung from a post in the centre to the sides. Each house has several fireplaces, and care is taken to keep the fire alive during the night to avoid the troublesome process of producing it by stick-rubbing.

Agriculture and fishing furnish the principal means of sustenance. The chase is comparatively unimportant. Dogs are unknown, and domesticated animals are limited to a few birds, principally of the parrot tribe. Corn, cotton, tobacco, sweet-potatoes and other tubers, are cultivated. Rice, cane, mandioca, and the banana are unknown. The plantations are of considerable extent, and compare favorably with those of the whites of Matto Grosso. The forest is cleared by the use of polished stone axes about the size of the fist, fixed in a wooden handle. The teeth of certain fishes serve for knives, and river shells as scrapers for working in wood. For hoes or ploughs, pointed sticks and the claws of the giant armadillo are used. The stones preferred for axes come from stream-beds in the possession of a single tribe. The commercial relations, however, are limited to an exchange of presents without idea of relative values. In the first trade made with the explorers, for an axe, a large canoe, which had to be carried for two leagues on the shoulders of six men, was gladly given in exchange. On another occasion a basket of fruit gathered in the presence of the party was offered for the same coveted instrument.

Another object of Indian barter is pottery, made only by the

women of certain tribes, all of which belong to the Nu-Aruak stock. Tattooing is also limited to the ceramic tribes. The most perfect objects of their industry are the masks used in dancing. The Tupi tribes make them of painted fabrics; the others, of wood, with large noses and small openings for the eyes, ornamented with a symmetrical design of the face.

In general, only the men take part in the dances, ornamented with feathers, and with the body enveloped in cloaks of palm-fibre. The step is marked by the shaking of a rattle, and the dance is accompanied by songs containing ancient words, some of which are evidently unintelligible to the Indians themselves. The only other musical instrument is the flute of one or three tubes, and of all sizes, from very small ones up to those in which the larger tube is as high as a man. In the dances great use is made of bows and arrows, and, in the Tupi tribes, of a peculiar form of arrow, shot, not from a bow, but from a throwing-stick held in the hand. The dances are held within or in front of the feast-house, called the 'flute-house.' It is believed that any woman who should venture to enter this house would die. In other respects, however, the position of the woman is not so inferior as is generally supposed. Although her position may be that of a servant, she knows, like her civilized sisters, how to obtain a fair share in the government. They are devoted mothers, though the children are held to have more intimate relations with the father, from whom they are supposed to derive body and soul, than with the mother. Parentage, however, is traced through the mother. On the occasion of a birth, the father remains for several days in his hammock on a diet of water and porridge. Marriage is monogamous, and is effected by the bridegroom taking his chosen bride to his lodge and hanging his hammock over hers.

The dead are buried in front of the feast-house, with the head to the east, holes or canals being made to facilitate the entrance of ants and other insects. The belief in a continuation of life after death is general. In dreams the soul is believed to leave the body and wander in the places dreamed of; and it is recommended not to awaken a sleeper suddenly, for fear the time may not be given for the return of the soul. They have many legends of their ancestors, which pass from generation to generation, and appear to contain many antiquated words. The idea of a personal God is unknown. The *pagés* pretend to control the storms, and all cases of illness or death are attributed to them. They are also the physicians, the treatment consisting principally in blowing tobacco-smoke on the patient. The blowing of smoke in the ears of guests is also a sign of friendship, and the latter are invited to moisten the ears of their hearers with spittle in order to be more clearly understood. The *pagés* appear to enjoy as much respect as the chiefs. The authority of the latter, unless it be in war, is not great. Dissatisfaction with the government is expressed by a migration in a body from the village, leaving the government to itself.

The number of Indians on the Batovy and Kuliseu is estimated at more than three thousand. Before returning, the explorers distributed among them their stores, including over fourteen hundred knives, so that the future traveller in this region will no longer find the stone age.

ORVILLE A. DERBY.

Rio de Janeiro, July 26.

Proceedings of the Society for Psychical Research.

IN a notice of the Proceedings of the English Society for Psychical Research which appeared in *Science* for July 20, a sentence occurs which may, I think, mislead your readers on a rather important point. The writer refers to the statement in the Proceedings, that certain girls, from whom experimental evidence of telepathy had been gained, were afterwards detected in the use of a code of signals; and he goes on to say, "If scientific observers can thus be deceived by young girls, . . . ought not this to impress upon every investigator the profound importance of acquainting himself with the possibilities of deception?" Your readers will probably infer from this that the experiments in which signalling was detected were carried on under conditions which the investigators in question had erroneously regarded as excluding the possibility of deception. This inference, however, would be altogether mistaken: the view which the investigators took of these experi-

ments was that expressed in 'Phantasms of the living' (chap. ii. p. 22), as regards earlier experiments of the same kind.

"Still such simple objects would not demand an elaborate code for their description; nor were any effective means taken to block the percipient's channels of sense. . . . We could not, therefore, regard the testimony of the investigators present as adding much weight to the experiments in which any members of the family were among the group of agents, unless the percipient was completely isolated from that group."

As is explained in the passage of the Proceedings to which your reviewer refers, the experiments in which signalling was detected were merely interludes among other experiments conducted under more stringent conditions, which were complete failures.

FREDERIC W. H. MYERS.

Cambridge, Eng., Aug. 24.

Effigy Mounds in Northern Illinois.

THAT imitative or 'effigy' mounds are to be found in northern and north-western Illinois has been asserted from time to time in works treating of the remains of the mound-builders; but no one seems hitherto to have gone to any great trouble to prove the fact, much less to accurately survey, map, and publish specimens of them—at least, not so far as I have been able to find out.

Mr. Lapham, in his well-known work 'Antiquities of Wisconsin' (1855), mentions mounds of the 'turtle' form on Rock River as far south as Rockford, and others on Apple River in Illinois, a few miles south of the State line of Wisconsin.

In the fifth volume of the 'Geological Survey of Illinois,' A. H. Worthen, director (1873), especial mention is made of ancient mounds at Rockford and in its vicinity, particularly the one known as the 'Turtle Mound.' He says it resembles an alligator with its head cut off more than it does a turtle.

The above is all the information I have been able to find in print on the subject, though possibly there may have been minor articles in newspapers or other periodicals, now as completely lost as the proverbial needle in the haystack.

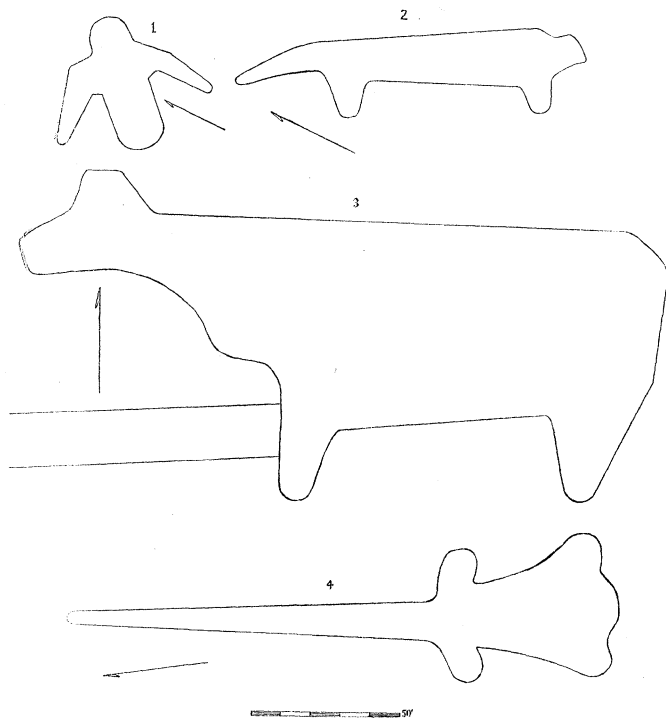
In a tour I made this spring in the region treated of, I looked for mounds of this class, and found them scattered at intervals along the Rock River valley, and also at points to the westward. I surveyed some of the best preserved of them, and here give succinct descriptions of four, which all differ from each other in shape, with necessary illustrative diagrams exactly drawn to scale from my field-notes.

The so-called 'Rockford Turtle' (1) in Winnebago County is situated between Main Street and Rock River, four blocks north of State Street, in the city of Rockford. It is 184½ feet long from the tip of its tail to the centre of the farther end, where a head should be, according to our ideas. It is three feet high at the junction of the hind-legs with the body, at the junction of the fore-legs and body the average height is 4 feet, but from the bottom of a slight swale that passes the head the height is 5½ feet. In connection with this effigy there is a bird (with one wing demolished), seven round mounds, and two embankments. These mounds are located on the most beautiful spot in the city, and, with one exception, have been well preserved by the owners of the land.

The bird-effigy (2) is on the east side of Rock River, some five miles below Rockford, on the N.W. ¼ of Sec. 14, T. 43, R. 1, E., in Winnebago County also. Its length from top of head to end of tail is 45½ feet; and from tip to tip of wings, following the centres, it is 68 feet. The height at the junction of the wings and body is 2 feet. While this is unquestionably intended to represent a bird, yet it is impossible to give it a closer classification. With it there are three embankments and two round mounds. The group is situated on a high bank some 45 feet above the river, and commands a fine view.

The animal (3) is on the N.W. ¼ of Sec. 22, T. 26, R. 2, E., some two miles below the village of Hanover, in Jo Daviess County, and on the east side of Apple River. Its greatest length in an air line is 216 feet, and the average height of the body 5½ feet. The body and head are on nearly level ground, while the legs run down the slope. The fore-leg rests on the end of an embankment which is 170 feet long and 1 foot high. From the general appearance at the

connecting point, it is very evident that the animal was constructed last. This overlapping of mounds is by no means uncommon in the North-West, and probably may account for the 'amalgamation mounds' of some writers. Besides the animal, there are in the same group twenty-three round mounds and ten embankments, as well as four other round mounds which have 'approaches,' or a low embankment, running from each.



A much less bulky animal (4) is on the S.E. $\frac{1}{4}$ of Sec. 13, T. 27, R. 9, E., some ten miles east of Freeport, Stephenson County, and on the north side of Pecatonica River. Its greatest length in an air line is 116 $\frac{1}{2}$ feet, and the average height of the body 1 $\frac{1}{4}$ feet. In the same group with it there is one embankment and seven round mounds, three of which are partially demolished. In one of the latter a fine hematite 'plumb-bob' was unearthed, in connection with a human skeleton which was badly decayed. Hematite relics in this region, and especially plumb-bobs, are exceedingly rare.

Near these mounds, but at the foot of the slope, there is a fine boiling spring of pure cold water.

Very few of these Illinois effigy mounds are in a good state of preservation; but I looked around long enough to find ten of them worth surveying, of which the four now given are the best suited for publication as types.

In surveying mounds of this class it has been a special object to get their true outlines as near as possible, without any preconceived ideas or fanciful imaginings as to what animal or other object they were intended to represent. To do this it is necessary to determine where the artificial ground ends on the natural surface. It is hardly possible, however, for the reader, even with the aid of faithful diagrams, to form an adequate idea of the beauty and symmetry of the effigies as they appear to the eye when in their undisturbed state.

T. H. LEWIS.

St. Paul, Minn., July 31.

The Coal-Measures of Kansas.

THE drilling of a 2,000-foot well at Emporia, Kan., has furnished an excellent section of the coal-measures of this State. The location of the section, unfortunately, can be given but approximately. Beginning somewhere in the upper half of the upper coal-measures, it ends in the lower third of the lower coal-measures. The section is very interesting, however, independently of its position in the formations.

In the depth of nearly 2,000 feet there are 112 strata with an average thickness of nearly 18 feet. Of these strata, 50 are shale,

50 limestone, and 12 sandstone. The limestone strata average 9 $\frac{1}{2}$ feet in thickness; the shale, 25 feet; and the sandstone, 24 feet. In the upper thousand feet are $\frac{1}{4}$ of the shale strata, $\frac{1}{10}$ of the limestone, and $\frac{5}{12}$ of the sandstone strata; but in the first thousand feet are $\frac{7}{12}$ of the shale, nearly $\frac{1}{2}$ of the limestone, and $\frac{1}{4}$ of the sandstone. The total thickness of the shale is 1,242 feet, limestone 465 feet, and sandstone 286 feet. Mingled with the shale are three beds of coal in the first 500 feet, and one bed in the last 500. The thicknesses average less than one foot.

The section teaches that the conditions under which the coal-measures were deposited were exceedingly variable, and that the tracing of the strata through eastern Kansas will not be a holiday task.

These deposits, even including the limestone, are mostly shallow-water accumulations, and are quite rich in fossils, especially the limestone. Incrusting corals, crinoid joints, and brachiopod and conchifer shells are especially abundant. Trilobites are rare.

L. C. WOOSTER.

Eureka, Kan., Aug. 31.

Radiant Energy.

IN your issue, Aug. 17, Prof. S. P. Langley, in his presidential address at the late meeting of the American Association for the Advancement of Science, puts his case a little too strongly in favor of Draper, I think, when referring to Melloni's statement of the relation between light and heat forms of radiant energy, made in 1843. He says, —

"So far as I know, no physicist of eminence re-asserted Melloni's principle till J. W. Draper, in 1872. Only sixteen years ago, or in 1872, it was almost universally believed that there were three different entities in the spectrum, represented by actinic, luminous, and thermal rays."

As a student at Dalhousie University, Halifax, Nova Scotia, before Draper's publication of 1872, I found Melloni's principle not only "re-asserted," but accepted. I fail to understand how it could be otherwise in the United States, when Tyndall's lectures and demonstrations in the Royal Institution were published in 1863, a quarter of a century ago; when the Smithsonian Report of 1868, twenty years ago, published Tyndall's Rede Lecture before the University of Cambridge in 1865, with translations of articles by Cazin and Magrini bearing on the same subject. But, more than that, Tyndall's lectures were published in a neat volume of some five or six hundred pages, by D. Appleton & Co. of New York, in 1870, two years before Draper's publication. I thought Professor Langley might have eminent "American physicists" in his mind; but his reference to the English cyclopædia of 1867 immediately before, suggests no such limit to his statement.

A. H. MACKAY.

Pictou Academy, Nova Scotia, Aug. 22.

[Mr. MacKay's letter may elicit more information on an interesting point, but attention should be drawn to the fact that he offers no evidence (i.e., cites no passages) to show that the lectures he mentions *do* quote any "physicist of eminence" in plain support of the doctrine in question. A statement as explicit as Melloni's or Draper's is what is wanted. Statements which might mean this (or any thing else) are plenty. —ED.]

The Laws of Corrasion.

UPON opening my copy of *Science* this morning, I am greeted with your note on Major Powell's "first formal announcement of a new law in the hydraulics of rivers" upon the relation between their corradng power and sedimentary load. I think you will find this principle fully stated by Major Powell in his 'Report on the Geology of the Uinta Mountains' (Government Printing-Office, 1876); but my object in writing is to draw your attention to the recognition of this "new law" in Chapter XVI., and especially p. 226, of the new 'Physical Geography' of Van Antwerp, Bragg, & Co. The law as enunciated in the first paragraph of *Science* (No. 290) is only true within certain limits, for the sedimentary load of a stream may become so great that it requires all the energy of the current to simply transport it, and hence there is little or no corrasion. The rivers of the Great Plains, — as Platte, Republican, Arkansas,

Red, etc., — which have a steep declivity, but flow in broad, shallow valleys, are examples.

This matter is fully discussed by Powell in the report above cited (1876), and by Gilbert in his report on the Henry Mountains (1880).

RUSSELL HINMAN.

Cincinnati, O., Aug. 27.

[Our esteemed correspondent misapprehends the scope and specific limitations of this "new law in the hydraulics of rivers," as he also does those of the law announced by Major Powell in his report on the Uinta Mountains, in 1876. In neither case is the law stated as a general one. Major Powell has never said, and does not now say, that in *all* rivers, and under *all* circumstances, "corrasion of every kind is increased by increase of load," although it may be true. But that is what our correspondent seems to suppose Major Powell's law of 1876 meant. Stated in its simplest form, the law of 1876 is as follows: "*In a region of degradation, vertical corrasion is increased by increase of load, in a diminishing ratio.*" He never dreamed at that time that this law could be generalized, or even that any similar law would explain lateral corrasion by a river flowing through a flood-plain. The new law which he now proposes as the result of subsequent study is, "*In a region of sedimentation* [and it must be noted that the flood-plain of the Mississippi is a delta region, and therefore a region of sedimentation] *an increase of load increases lateral corrasion in a geometric ratio.*" We did not emphasize this distinction in the brief editorial reference which we made to Major Powell's paper, assuming that any reader who had given especial attention to the study of the hydraulics of rivers would make it for himself, certainly if he read Major Powell's paper printed in the same number of *Science*, and beginning on the same page with the editorial paragraph referring to it; for all others the law was stated in the least confusing, although perhaps not in the most comprehensive language. — ED.]

A Notable Evolution.

THE remarkable power of the catbird as a singer is known to all those who give it a safe and welcome retreat. Yet I find even such writers as Baird describing it after this manner: "An American bird of the thrush family, whose cry resembles the mewing of a cat." In reality it is the mocking-bird of the North, possessed of ability to sing whatever notes he hears. I have them so perfectly at home in my grounds, that their delicious music is heard at all hours of the day, and often in the middle of the night. It is very curious to hear one of them warble in a low key to himself what some other bird is singing loudly. A few days since I heard one mimic a red squirrel, and he did it to perfection. If he had not enjoyed the fun so well that he could not keep from hopping about, I should not have known which was squirrel.

I did not, however, intend, except incidentally, to write about the catbird, *Mimus Carolinensis*. It, however, makes it easier for us to conceive the possibility of an evolution of superior vocalization in his relatives, when we consider his masterly ability. What I wish to record is a remarkable development in the case of his cousin the common robin, or migratory thrush. Every one knows what a clumsy singer he is, having a rough, see-saw note, that he repeats with little variation. For some reason the other birds give him precedence in the morning song with which daylight is greeted about half-past three in June. The first note comes always from the east, — a faint, far-away cry; then another cry leaps out of a tree nearer you, and then another and another. So the wave of robin-melody moves westward, over the house and over the land, preceding the rising sun, probably from the Atlantic to the Pacific. This song is peculiarly adapted to constitute a matin cry, being clear, strong, and cordial. But it is not musical. In June of 1887, crossing one of my lawns, I heard a cry so peculiarly like articulation that I was startled: "Hear this birdie! Hear this birdie! Hear this pretty birdie!" the last notes being exquisitely rendered, with a wave and upward bend. I had never heard such a song before, and imagined a new species of bird must have arrived; but after careful examination, I found the singer to be a veritable robin-breast, and not a new-comer at all. The song was repeated all

the summer, to the delight of myself and friends. Of course, I awaited the opening of spring with anxiety, to know if our birdie would return. Almost the first song of spring, sure enough, was one morning in April: "Hear this birdie! Hear this birdie!" But, better yet, it was apparent that the babes of this family were singing, not the old robin's see-saw, but the new song. And now about my place are three or four of our birdies. What was notable was not only the remarkable evolution of musical power, but a love for music; for our birdie, unlike the robins in general, sang all day, like the catbirds. I could hear one or more at almost any hour. This drew my attention to the cause of the unexpected variation. John Burroughs suggested that it might be the song taught to one that had been caged and afterwards escaped; but I am more inclined to think that it is a natural variation or evolution, and that the robin has great and undeveloped power. It is a phlegmatic bird, that takes the world easy, and is not likely to exert itself in new directions. The catbird is fond of notice, likes to be whistled to, and enjoys answering back. He is likely to develop all sorts of new vocal accomplishments. But the robin is really lazy, and does as little hard work as possible. His nest is a clumsy affair, a mere daub of mud and sticks. Why has he begun this new song? Is it from being so constantly with catbirds, gross-beaks, orioles, etc.? for my nine acres are the paradise of birds. They are covered with fruits, hedges, trees. I do not know, but believe, some such cause to be at the bottom of the affair, and that we may look for other developments quite as remarkable. Within the month of June, while driving about five miles from my home, I saw a robin sitting on a wayside fence, and singing a set of notes most charmingly unlike any thing I had ever heard; neither was it at all like our birdie. It was as complex as a catbird often sings, but not apparently imitative. This has led me to a very decided conviction that an evolution in robin-music is now going on, and that some very delightful results may be looked for. I shall be glad to get notes from observers in different parts of the country. Of this I am certain, that our common thrush has a vast vocal power undeveloped. Evolution with birds must move, as it has moved, in the line of music, plumage, and flight, and nest-building. Nothing in these directions need surprise us.

I subjoin a note taken from a paper published near New York City, over two hundred miles from here: "Thomas O'Donnell of Rondout has a robin which whistles like a mocking-bird. This is probably due to the fact that it was raised in company with a mocker. The robin whistles 'Johnny, get your Gun,' and 'Don't leave your Mother, Tom!' Its powers of mimicry are wonderful. In the early morning, when things are quiet, the whistle of the bird has been heard a quarter of a mile. One day recently a man went into a saloon over the door of which the robin hung. The bird gave a sharp, quick whistle, which a man across the way, seeing his friend enter the saloon, considered a call to get a free drink. The man who first entered the saloon denied having whistled, but he nevertheless stood treat." I am confirmed by such reports in the belief that we shall see a remarkable evolution of robin-music. Our homestead pet and universal favorite will then be all the more dear.

E. P. POWELL.

Clinton, N.Y., Aug. 28.

Queries.

36. DOUBLE FRUIT. — Last May a gentleman brought into my office a peach-tree branch quite thickly covered with small green peaches, most of which were double; that is, consisted of two (in several cases three) peaches, more or less completely fused into one. Some of the members of these doublets were hardly distinguishable as such, except by the fact that they had two stones; while others were scarcely united, and a few were entirely distinct from each other, but had only a single stem. Later I learned of such peaches being common in two other widely separated localities in this State this year, but no one had ever seen them in any previous year. I have also a collection of ripe cherries doubled in a similar way, and gathered this year from a tree in this city. Is this a common phenomenon? What is the appearance of the flower which gives rise to this double fruit? J. L. H.

Louisville, Ky., Aug. 7.